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ABSTRACT

A school construction guide offers key personnel in school development projects information on the complex task of master planning and construction of schools in Australia. This chapter of the guide provides advice on how educational buildings should be designed to permit technological change with efficiency and minimum expense. Issues examined involve computers and buildings; industrial technology; integration of technology and other disciplines; and special requirements of storage, supervision, and after-hours use. Also discussed are the principles of good maintenance and recordkeeping; and documentation needs for equipment, services, and providers. (GR)

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ED 436 078

School Buildings

Planning, Design and Construction

John H Odell FRAIA ASTC
in association with the
Association of Independent Schools of NSW Ltd

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TECHNOLOGY AND EDUCATIONAL BUILDINGS and RECORDS FOR MANAGEMENT OF BUILDINGS

7

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School Buildings, Planning Design and Construction is presented in a ring binder with 8 booklets. The document is available only as a complete set

1 Introduction and Chapter 1 – Developing a Master Plan

2 Chapter 2 – Making the Most of Your School Site

3 Chapter 3 – Principles of Good School Building Design

4 Chapter 4 – Purpose Designed Facilities

5 Chapter 5 – Construction Methods and Materials

6 Chapter 6 – Managing the Construction Process

7 Chapters 7 and 8 – Technology and Managing Buildings

8 Appendices

ISBN 0 646 23758 6 refers to the complete set of 8 booklets

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Epping NSW, Australia

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School Buildings - Planning, Design and Construction

A Guide Document

for School Councils, Boards and Committees, School Principals and Staff and Construction Professionals

Author - John H Odell FRAIA ASTC

Introduction to

School Buildings – Planning, Design and Construction

Good school buildings do not just happen. Thought and consideration must be given to the needs of the users of the building and to the available resources. The persons responsible for building the school should have considerable experience or draw on the advice of those who have.

For a building to be satisfying and successful it must provide shelter, have durable construction and finishes, be aesthetically pleasing and appropriate to its use. A well-planned school will incorporate the following points:

- buildings and grounds will satisfy and support both short and long-term requirements
- curriculum demands including requirements for registration by authorities will be met
- site development will not be haphazard and each project will pave the way for the next
- building design will be flexible to cater for as yet unknown future requirements
- building will be cost effective - and in the long term the school will avoid unnecessary expensive recovery action
- good building design will encourage a high quality educational environment
- pre-planning of maintenance requirements will assist in reducing operating costs

This guide is designed to assist key personnel in school development projects with the complex task of master planning and construction of schools.

Individual chapters in this guide may be distributed to relevant key personnel as appropriate to their specific interest and responsibility.

Each chapter is a separate booklet with chapters 7 and 8 bound together in one booklet and chapter 9 in booklet 8.

The chapters:

1 Developing a Master Plan for Your School

2 Making the Most of Your School Site

3 Principles of Good School Building Design

4 Purpose Designed Facilities

5 Construction Methods and Materials

6 Managing the Construction Process

7 Technology and Educational Buildings

8 Managing School Buildings

9 Appendices

This Guide aims to:

- demonstrate the necessity for school communities to produce comprehensive master plans for the development of their school
- encourage school staff and boards to be involved in the development of school facilities and to draw on the wider experience of the community during that process
- outline planning processes and techniques that will lead to greater creativity in school design with greater efficiencies and productivity in the construction process
- help school staff and board members in their dealings with professionals in the building industry, and vice versa
- encourage excellence in school facilities
- maximise potential of limited resources to achieve desirable outcomes
- provide advice on how to determine whether a particular facility is vital to a school
- provide examples of excellence in school building and planning
- provide a comprehensive list of contacts, resources and references.

Who should read this Guide:

- All school council/board members
- Principals, bursars and other key staff members
- All members of school building and planning committees
- Administrators in control of school building projects
- Construction industry professionals, especially school architects

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7

Technology and Educational Buildings

7. Technology and Educational Building

At the heart of the technological revolution in education is the computer and related resources, such as worldwide information networks (Compuserve, Internet) and data transfer, hard wire, optical fibre and microwave link systems.

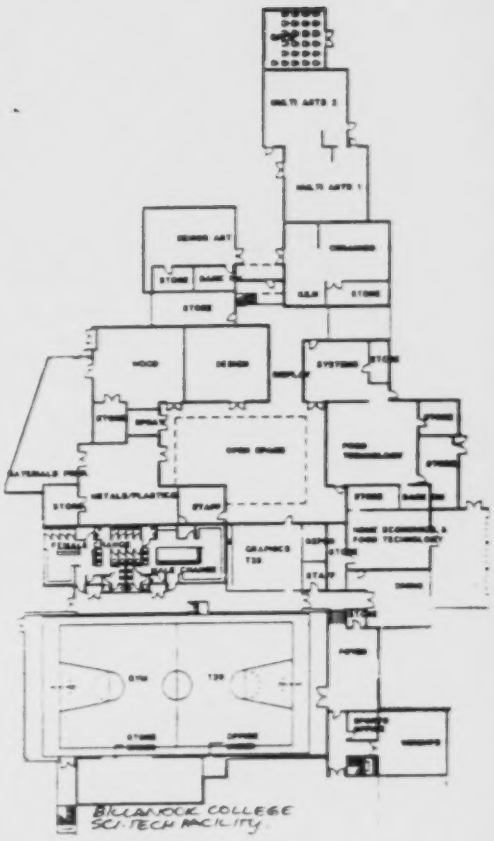
Schools need to prepare students for a world which is increasingly relying on computer technology. Students' academic work will involve computers and probably their future employment will involve computers whether directly or indirectly.

There are a number of questions for educators to address, but the one we are concerned with here is: how should educational buildings be designed to permit technological change with efficiency and minimum expense. Issues covered in this chapter are:

- Computers and buildings (7.1)
- Industrial technology (7.2)
- Integration of technology and other disciplines (7.3)
- Special requirements (7.4)

Designing schools for introduction and teaching of the new technologies.....adapting to change.

The increasing effects of teaching on the school curriculum in recent years is already impacting on school facility design and/or the use and types of equipment schools are having to purchase.



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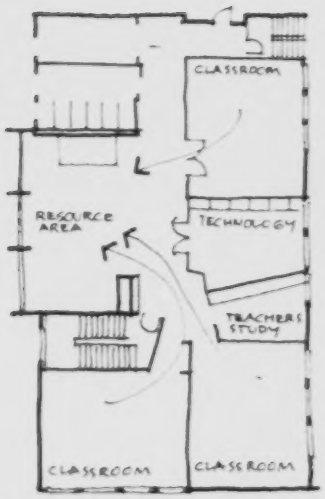
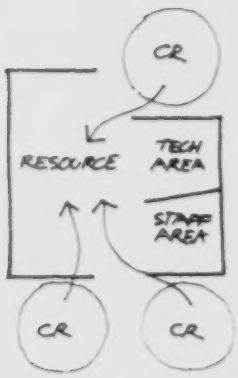
7.1. Computers and Buildings

Computers are having an impact on schools in a variety of ways. The following will be covered in this section:

- impact of computer technology on school buildings (7.1.1)
- Support and maintenance facilities and Services (7.1.2)
- support equipment for computers (7.1.3)
- furniture for computers (7.1.4)
- room design for computers (7.1.5)
- power supply for computers (7.1.6)
- data handling (7.1.7)



AN EXISTING BUILDING ADAPTED FOR COMPUTERS
FROM REDEFINING THE PLACE TO LEARN SUSAN STUEBING - OECD - CERA ADELAIDE 1994



7.1.1. Impact of computer technology on school buildings

The emerging new technologies are requiring different types of spaces in schools. This can range from stand alone computer education classrooms to additional storage space.

Computers are not only being used for data storage and retrieved through sophisticated resource centres, but also as a direct tool in specific subjects (e.g. Technology and Applied Studies (TAS) requiring specific software (e.g. CAD).

Classrooms need annexes for students to sit at computer terminals, for recharging batteries of lap-top computers, for printers and paper storage as well as related equipment such as file-servers and computer-based visual aids and visual aid equipment.

The lighting quality of computer rooms should be low subdued and the room finishes low-key in colour and non-reflective to minimise distracting reflections on computer screens. Wall floor and ceiling finishes, the kind of light fittings, mechanical ventilation/air-conditioning, acoustics are also areas of special consideration and will be dealt with in greater detail further on in the document.

The security aspects associated with computers must be given a high priority as modern equipment is very portable and vulnerable to damage and theft.

The changing emphasis in the teaching of technology subjects will have an impact on the building. Buildings will have to provide

- greater individual enquiry and experimental investigation
- individual focus of study for students particularly at senior levels
- a collaborative approach with teachers guiding students, require
- a room layout which allows free movement
- an individual work environment for discussion, without unduly disturbing other students.

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7.1.2. Support and maintenance facilities and Services

As computer numbers grow so will maintenance problems. Some of these can be resolved by a reasonably skilled teacher (provided an equipped and dedicated maintenance workshop is available). The maintenance workshop can be part of the overall program of learning for students. While it will remain a place principally for staff, selected students with an interest in a career in computers should be encouraged to use such facilities. The design of the room would need to allow sufficient space for this.

Regular access to repair and maintenance facilities will be required for modification and upgrading to cope with rapid change in the technology available to schools. This is dealt with in more detail in 7.1.7 Data handling and management.

7.1.3. Support equipment and services for computers

In supporting the provision of computer hardware the following equipment needs to be provided and accommodated:

- Printers need to be provided where they are readily accessible to students yet protected from vandalism and theft. Annexes close to or part of computer teaching staff areas is one possibility.
- Battery chargers: schools requiring students to have lap-top computers need to provide secure storage for these and as part of that storage, power outlets to allow for battery recharging.
- Telephone links: students learning to use external data banks will need access via telephone lines. In most cases this will be via the school computer network. Nevertheless planners need to be aware of the additional telephone line capacity that will be required. In some cases the system may require higher level of communication via what is known as Integrated Services Digital Network (ISDN) rather than the standard telephone network known as Public Switch Telephone Network (PSTN)
- Visual aid equipment: increasing sophistication in computers allows greater variety in visual display apart from the computer monitor e.g.
    - ✓ Attachments to overhead projector: which allow the projection of a computer screen for classroom instruction.
    - ✓ Video projector: which converts the computer screen image direct to a video image for projection to a wall screen.

7.1.4. Computer Furniture

Furniture needs throughout the school will be different where computers are to be used. When selecting furniture for computers, planners should take into account:

- the need for power and data cabling to each student workplace (unless students are to rely on lap-tops)
- ergonomic aspects of furniture - correct height and slope of desks, preferably adjustable with adequate support for arms and wrists. Quality chairs, preferably with back and seat adjustment (gas-lift for height adjustment). Standard

classroom chairs are NOT suitable. Professional guidance should be obtained.

- subdued furniture colour to complement the colour scheme of the room
- cabling requirements - need for linking together the furniture in a safe way for power and data cabling

7.1.5. Planning for Computers

When planning for computers, the following aspects of the building should be taken into account:—

- will separate computer education rooms be built or will computers be integrated into classrooms
- are supplementary spaces required in or near specialist areas e.g. design rooms in technology areas
- will small annex rooms be constructed to house computers - with ready access to the classroom
- how flexible in design should these rooms be?
- how are computer rooms to be supervised?
- security and storage of equipment after hours
- lighting (different to classrooms)
- spaces capable of being used by more than one class
- storage for software

7.1.6. Power supply for computers

Uninterrupted power supply is very desirable for computer rooms. This can be achieved simply by running the system from a battery and having those batteries on continuous charge, instead of connection to the main power system which is subject to power surges in the power lines.

A less expensive alternative is to have a small battery system capable of "clicking in" when power is lost but with sufficient power capacity only to sound an alarm and to permit closing down the system.

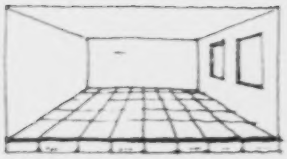
If the above alternatives are considered too expensive some means of protecting the power supply from the "spikes" or surges in power which occur as a result of faults in other equipment, lightning strikes and the like, should be installed as the barest minimum of protection for the computer equipment.

7.1.7. Data handling and management

The process of managing data systems in buildings calls for: more space, different kinds of service spaces and more convenient access to cables and junctions.

Rooms which require significant cabling for data systems may be designed using one of the following options:

- ceiling grids
- underfloor grids
- floor trunking



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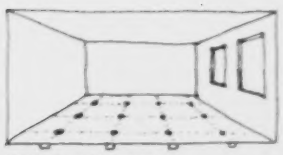
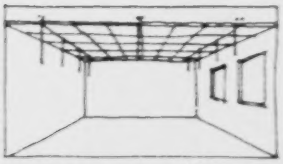
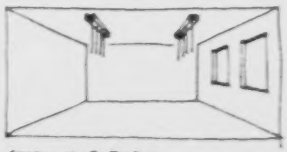


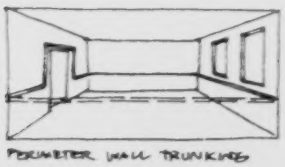
FLOOR TRUNKING



SUSPENDED CEILING/CEILING GRIDS

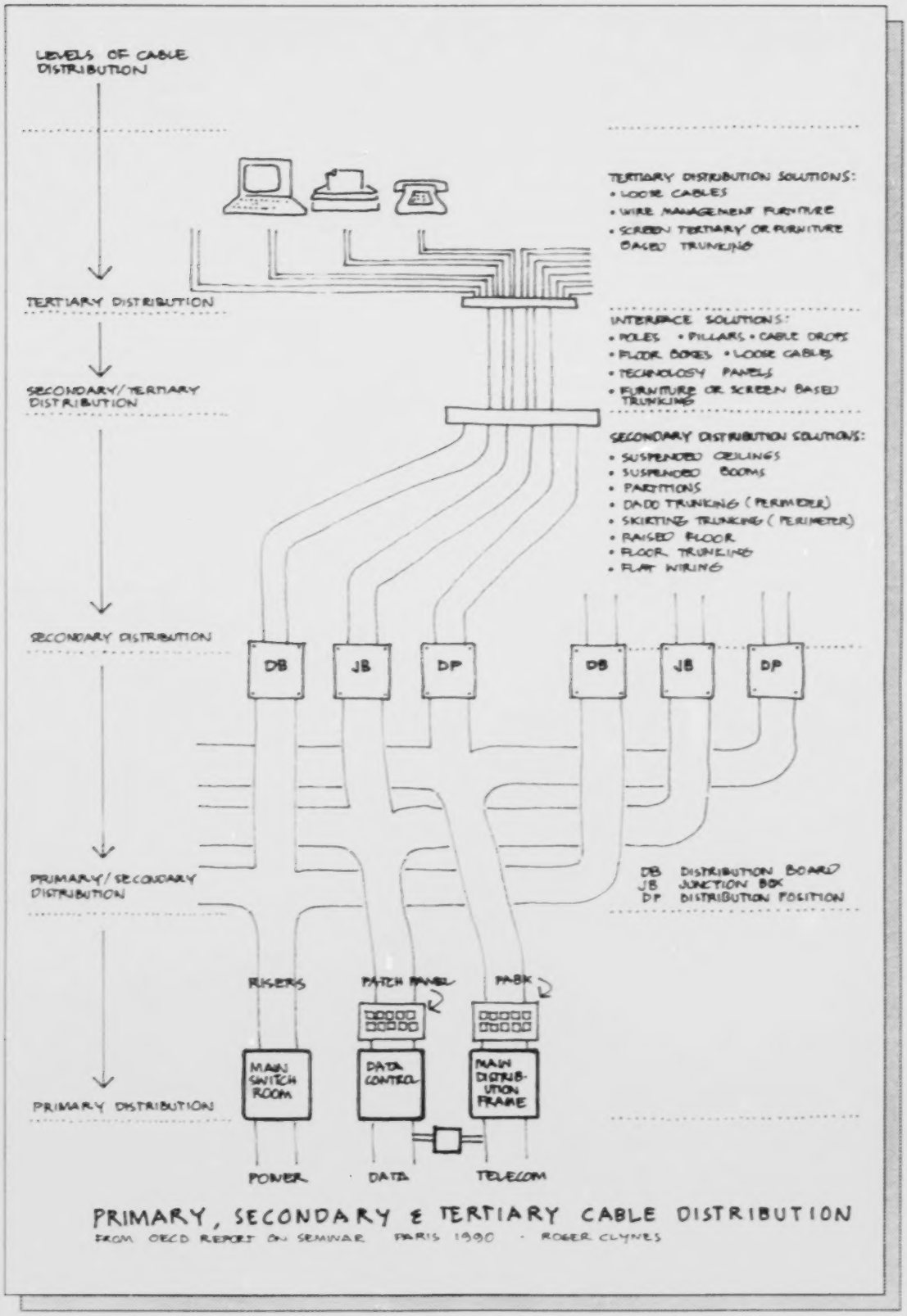


SUSPENDED BOOM



PERIMETER WALL TRUNKING

CABLE MANAGEMENT
OECD REPORT PARIS 1990



PRIMARY, SECONDARY & TERTIARY CABLE DISTRIBUTION

FROM OECD REPORT ON SEMINAR PARIS 1990 · ROGER CLYNES

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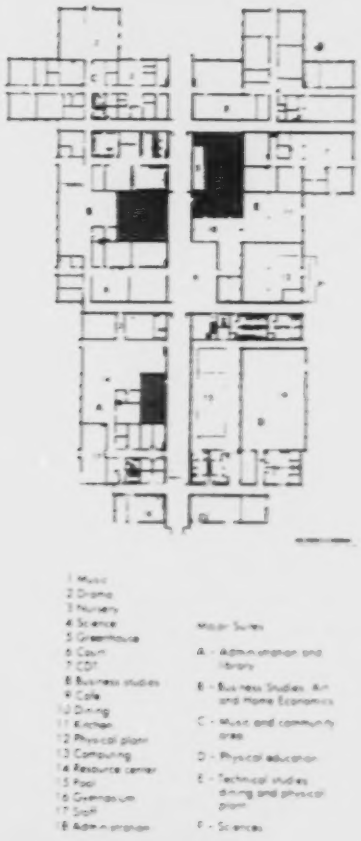

NEW LEITH ACADEMY
EDINBURGH, SCOTLAND

Ceiling grids are unsightly, but quite accessible and economic. Underfloor grids are closer to where the information is required and are very accessible, but expensive and vulnerable to damage from spillage in areas where this is a consideration (e.g. science areas). Floor trunking is very accessible but also expensive and more appropriate for the commercial environment.

Other forms of cable management include:

- raised floor
- suspended boom
- perimeter trunking

In "Redefining the Place to Learn" [1] the author says of New Leith Academy, Edinburgh, Scotland. "The design of this 'school of the future' features four key elements: (1) a modular system provides flexibility for change; (2) an internal 'street' facilitates community access, ease of circulation and energy efficiency; (3) provision for the increasing use of information technology is included; and (4) reference to vernacular architecture to humanise the scale of the building."

The main building components are arranged around a main "street": an enclosed space providing a main thoroughfare with a second storey providing for delivery of power, networking and environmental system. Maintenance and modifications can be carried out with minimal impact on day to day activities.

Other multi-storey schools provide for a crawl space under each floor for the same purpose.

These are quite expensive solutions if introduced solely for data transfer systems. They can be cost effective if the spaces provided for computer cabling are used for other services such as air-conditioning, plumbing, power cabling as well as access generally.

A simpler solution involves ducting or vertical trays to which cables are wired. These can be covered or exposed. Covered, they appear neater, but are vulnerable to overheating, build-up of dust and provide a "cosy" environment for rats and mice - a threat to cable systems.

Networks

Networks are cable systems linked to computer equipment to handle the transfer of information or data as it is usually referred to from data banks either within or outside the school.

External data sources are accessed via telephone lines or microwave links. In the case of the latter, space must be designated for the microwave dish, adequate structural support must be available for the antenna as well as access for personnel involved in maintenance and installation.

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[1] *Redefining the Place to Learn - a Study of Technology and the Design of the Learning Environment by Susan Stuebing - New Jersey Institute of Technology OECD PEB LETA 94*

Microwave links

Microwave links are part of communications networks involving microwave signals between antennae usually mounted on roofs of buildings. They rely on direct "line of sight" to be effective. They emit radiation which is highly dangerous to the human body so care must be taken in locating these away from student reach or exposure.

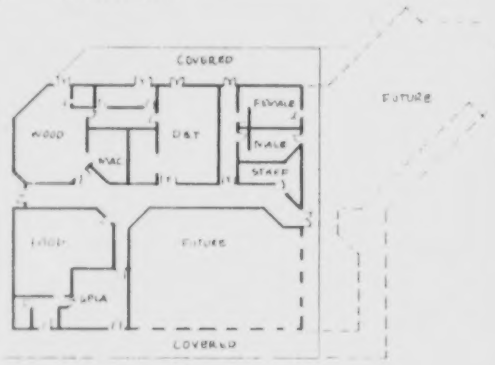
STAGING FOR TECHNOLOGY

As the demand for technology spaces grows the school must plan for the appropriate spaces during the growth phase. Here is how Pacific Hills Christian School, Dural NSW has planned for growth in its new technology centre.

Architects A K Werry Pty Ltd and Andrew Blamey in Association

7.2. Industrial Technology

Industrial technology is an area of education undergoing rapid expansion in the curriculum as well as in the need for increasingly sophisticated space and equipment.



STAGE ONE

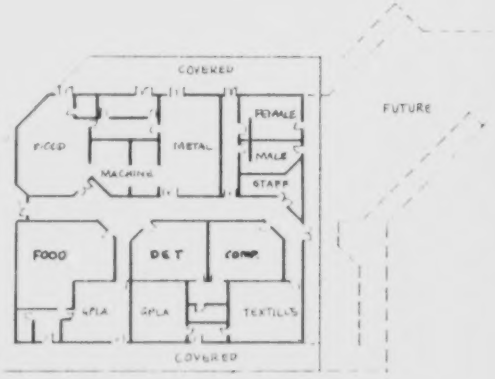
7.2.1. Disciplines

Students today are exposed to and have hands-on experience in the following disciplines:

- Drawing - Computer-aided design
- Electronics
- Pneumatics
- Plastics
- Metal
- Wood
- Food technology
- Textiles and Design

Such wide ranging technologies require sophisticated facilities and are generally best served in purpose designed buildings.

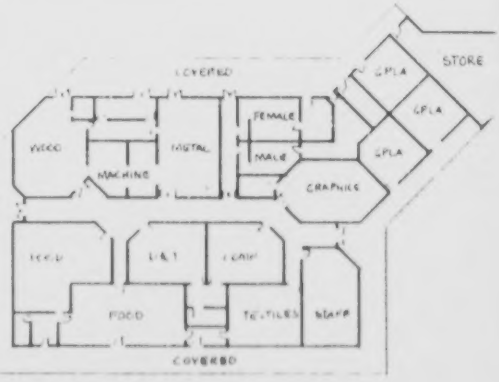
Where existing schools are embarking on a program to upgrade facilities for these programs some are solving the problem by starting from scratch rather than trying to convert existing buildings.



STAGE TWO

Some examples of excellence in schools:

- Immanuel College Technology Centre in Adelaide, SA: rooms set aside for computers are adjacent to the workshop areas, highlighting the important link between technology and computers. The high quality and serviceability of the finishes are uniquely compatible with computers. Excellent visibility between nearly all spaces makes the area workable and convenient for both staff and students.
- Technology Centre, Beaconhills Christian College, Packenham, Vic.: While the room layout is more traditional, the facility is noteworthy because of the linking of the sciences, technology and computing in one centre. This design facilitates the use of techniques and equipment as well as the sharing of expertise across disciplines.



STAGE THREE

7.2.2. Spaces for Industrial Technology

Given the wide variety of technologies now being taught in schools it is appropriate to provide multi-purpose spaces for technology

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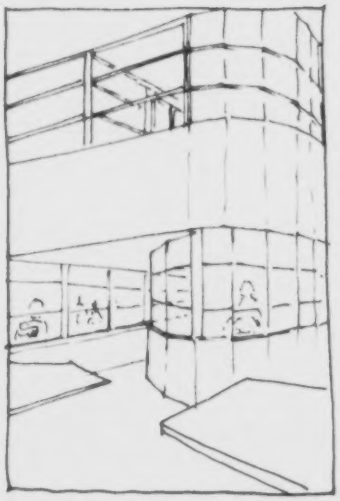
studies. The finishes and general services should be appropriate for any of the technologies, and special services specific to any of the technologies may be installed as necessary. This will allow for changing emphases and new technologies with minimum impact to the school building.



IMMANUEL COLLEGE Adelaide
GEOFF NAIRN · ARCHITECT
NOTE : GLAZING ALLOWS EXCELLENT SUPERVISION OF TECHNOLOGY AREAS

General characteristics of these spaces:

- hard and durable floors finished with a non-slip vinyl capable of enduring heavy wheel and point loads
- wall finishes capable of resisting damage from trolleys and tools
- ceilings to absorb sound from machinery and general reverberation
- large access ways for manoeuvring machinery and materials
- good access to stores
- high level of lighting - daylight if possible
- excellent ventilation, exhaust system where fumes are likely
- good access to computer rooms for design work to be carried out in conjunction with the manufacturing process
- good visual access to all rooms from corridors and adjacent study/design areas
- good supervision from staff areas

7.2.3. Services for Industrial Technology

The services now being required in technology areas are quite varied. With these additional services will be a requirement for skilled and competent management of them.

The services include:

- 240V power
- 12V power
- 12V d.c. power
- vacuum lines and equipment
- air pressure lines for pneumatics studies
- oxygen and acetylene for welding
- data cabling (shielded to limit interference from equipment on computers)
- dust extraction system

These services should be installed in such a way that they can be extended to new areas with little difficulty. This may mean including take-offs, branches, junction boxes and certainly markers to assist in locating these services at a later time.

With safety in mind the load on power circuits should be taken into account as fires can easily result from overloaded circuits.

7.3. Integration of Technology and the Visual and Creative Arts disciplines

The visual and creative arts disciplines are becoming increasingly dependent on technology, and in the future, school buildings will have to incorporate greater access to a wider range of the various technologies in teaching these subjects.

Because of compatibility of services and equipment, there is sense in linking technology areas with the Sciences and Arts. Integration permits greater use and less duplication of services and equipment, as well as better utilisation of space.

Given the high services component of arts facilities in schools, the following Creative Arts classes can be integrated with the technology areas with consequent savings and other benefits such as a greater availability of equipment. The savings will come from the use of shared spaces and equipment.

- Computer Art
- Photography
- Sculpture and 3 dimensional work generally involving casting, sheet metal, wire, plastic, moulded and cast and many others
- Painting and Drawing, using wider range of application methods such as spray painting, mechanical drawing, etching

7.4. Special Requirements

This section will cover the technology requirements for:

- storage (7.4.1)
- supervision (7.4.2)
- after hours use of facilities (7.4.3)

7.4.1. Storage

Due to the significant use of equipment and materials in technology rich areas storage is a primary concern for planners. Planners should require of the users a detailed analysis of the various articles to be stored and accessed.

Distinguish between:

- material to be used rarely and that to be used regularly
- teacher and student access.

Upper level storage may be a space-saving solution.

Heavy equipment may require the use of truck access into the store and a hoist to lift it from the truck. Alternatively some delivery trucks have hoists, in which case sufficient space including head room for hoist should be provided for the truck to off-load the equipment and for manoeuvring trolleys.

Rolling shelving (often referred to as "compactus") may be considered to save storage space, however it may not be suitable where student access is required as the momentum of heavy rolling shelves can be a hazard to smaller children. Allowance for increased load must be made in the structural design of floors.

7.4.2. Supervision

Current trends in industry workshop environments provide every possible safety measure to protect workers from injury. In schools safety supervision is even more important because students are less experienced and more inclined to mischief.

Try to plan sspecialist facilities in close proximity to the staff room and where as many as possible of the student areas, including store areas, are visible from the staff area.

An excellent example of this is the Technology Science facility at Beaconhills Christian College, Victoria where the staff facility is elevated and windows provide direct vision to adjacent rooms and to rooms beyond through further windows on the opposite side of the room. Another good example is Emmanuel College, Adelaide where most of the rooms have glass walls above bench height.

Supervision is also possible in sensitive areas by means of television cameras, preferably activated by movement sensor and linked to an alarm system. A sensitive area may be expensive equipment is located, or where volatile or expensive materials are stored. Another is where computer data storage equipment is located such as file servers or network hubs.

7.4.3. After hours use

Maximising the use of the new technologies in schools may mean making them available to the community after hours, requiring:

- independent access without opening up the remainder of the school
- security systems allowing isolation of these areas so that the remainder of the school remains secure
- access to emergency services, telephones, toilets
- access to clerical facilities such as photocopier, separate storage facilities for after-hours users who are engaged in long-term projects.

8

Managing School Buildings

8. Records for Management of School Buildings and Sites

On completion of a building or site development project, the facilities should be handed over from the building contractor to the school authorities in a way that maintenance programs can be properly implemented. This can be done by having a management program for the building services and equipment for a defined period included in the cost of the project. Doing this allows tome for an effective transfer of responsibility from the construction authority to the owner.

This chapter is not intended as an exhaustive study of all aspects of managing school buildings and sites. Instead, it provides tips on responsibilities and record-keeping and advice on how to avoid some of the pitfalls:

- principles of good maintenance and record-keeping (8.1)
- documentation on equipment, services and providers (8.2)

8.1. Principles of good maintenance and record-keeping

Building maintenance is concerned with keeping good visual appearance and useability while fostering a caring attitude among the users and keeping costs as low as possible, both short- and long-term.

> *...planning is required to ensure the completed facility has maximum effectiveness at minimum cost....*

It is important to establish a maintenance policy and regime at an early stage, well before detail design commences as it has a bearing on material selection and the way materials are put together.

The OECD Document "Maintenance of Educational Buildings, Policies and Strategies" is an excellent resource (see Appendix 9.7).

8.1.1. Essential Maintenance Records

1 As-built Records

2 Detailed Cleaning and Maintenance Record

3 Condition of Premises (updated annually)

4 Priority order of work

5 Cost estimates based on historical data from item 2 above.

6 Maintenance manuals and guarantees

As-Built records

The various construction contracts should require a detailed set of documents to be made available upon completion, showing every aspect of the work, especially the location and depth of underground services in relation to easily identifiable fixed elements of the building.

The relevant consultant should be required to check these documents prior to handing the building over to the school.

Where Computer Aided Drawing (CAD) has been used to prepare drawings it is a relatively simple process to update the working drawings for this purpose. Sometimes consultants offer their services to assist in the preparation of these as-built drawings but it must be emphasised the responsibility for correctness must lie with the constractor.

Schools should also consider asking for the information to be provided in CAD format (for those schools with CAD resources) as well as in the form of drawings as part of the fee and/or contract package. In any case the school should require of consultants in the fee agreements that the CAD records be passed to other consultants should new consultants need to be appointed for any reason.

Detailed Cleaning and Maintenance Records

To properly estimate on-going budgets for cleaning and maintenance, accurate records are necessary.

We are not discussing the day-to-day cleaning, that too should be subject to careful analysis. Rather we are concerned here about those special items such as high-level glass cleaning, roof gutters, drains and sumps, external walls and eaves, ceilings and walls, external paved areas where grime and mould accumulate.

Maintenance will include:

- equipment (usually specified in the maintenance manuals provided with the equipment)
- fume cupboard and exhaust systems
- dust and sawdust extraction systems
- air-conditioning and ventilation systems
- repainting walls and ceilings

- replacement of floor coverings
- external painting
- replanting, weed control and fertilising gardens
- lawn maintenance (fertilising and weed control)
- high level glass cleaning
- roof drainage and ground level sumps
- external paved areas

All of these will require a plan as well as a management program to ensure that this work will be carried out.

Condition of Premises (updated annually)

This report supplements the maintenance program and records and can be used to evaluate the program. It is good policy to have a person other than the maintenance staff carry out this analysis.

Priority order of work

There will be times when maintenance staff are unable to cope with all the work that is required. This is more likely when unexpected crises emerge such as burst water pipes, blocked drains and flooding. Therefore, a priority plan should be available to ensure that essential maintenance (e.g. on equipment) is carried out on time. Neglect of either emergency or essential maintenance may precipitate further costs and delays.

A priority guide will help to determine whether additional assistance is needed.

Cost estimates based on historical data

Properly kept records of maintenance and special cleaning from year to year are a valuable resource in forecasting costs for future years as well as assessing effectiveness of maintenance and cleaning programs.

Maintenance manuals and warranties

Correct and current specifications and maintenance manuals should be obtained for all materials and equipment as quickly as possible. The longer the delay, the more difficult they are to obtain, because equipment and materials become outdated very quickly. The contract should include some requirement for this information to be made available to the school.

The following is a guide to the range of information that should be obtained:

- cleaning and care of floor finishes,
- white boards,
- ceiling tiles in suspended ceiling systems

- carpets, differing regimes apply for synthetic, wool and wool blends
- spot cleaning of floor finishes, especially carpet for the likely range of spillages to ensure damage does not occur in the cleaning process
- cleaning of metal window frames and doors - harsh cleaning agents can damage finishes
- special bench materials such as in Science and food technology rooms

Paint specifications to assist in upgrading programs

Secure from the Contractor a list of all paints and colours including brands and their location (obtain if possible a sample board) to ensure that upgrading paint programs will be compatible with the underlying original paint surface.

This is particularly pertinent where special paint finishes are applied such as in toilets, food service areas and science rooms.

8.1.2. Maintenance funding and operation

The cost of operation and maintenance of sophisticated equipment such as air-conditioning and mechanical ventilation, PABX systems, data systems, is usually significant and should be line item in the school budget. The process is fairly complex and demanding if done properly.

The design consultants can be a useful resource in providing this information but will do so only if requested. There may be a fee associated with providing this information. Contractors may provide this information with a proposal to provide such maintenance on an on-going basis. Information offered in this way should be carefully evaluated by professionals before being accepted by the school.

8.1.3. Collect information on building systems and its performance in use

To properly assess maintenance and performance, on-line data recording equipment can be installed. This equipment will assist in determining whether the system is delivering the service it was designed to do. Information such as temperature of intake air compared to output temperature can be provided as a continuous record.

This information linked with maintenance activities will show the degree to which maintenance assists in design performance.

8.1.4. Move decisions as close as possible to point of effect

This means giving decision-making capacity to those most affected. The more remote the decision makers are from the impact of the decision, the less likely it is to be made. Decision-making power must be linked to accountability.

8.1.5. Training in problem solving

Encourage staff, particularly those involved in maintenance areas and educational staff having maintenance responsibilities to familiarise themselves with the operation of the equipment so that they can correct minor problems themselves.

In this way some expensive maintenance calls can be avoided and users will have a better appreciation of the capacity and limitations of the equipment.

8.1.6. Insisting on quality in school environment

Maintaining buildings and equipment in efficient working order can be greatly assisted by school management insisting on high performance standards with respect to the school in general including, clean and tidy environments, staff rooms and classrooms free of superfluous equipment and refuse, general order and discipline in furniture arrangements, careful management of grounds.

This discipline can then be more easily applied in the areas that are not so obvious; store rooms, maintenance facilities, equipments and mechanical plant rooms.

Untidy facilities make proper maintenance difficult and costly. They discourage excellence on the part of contractors and staff and send wrong messages to students regarding the use of assets.

8.2. Documentation on equipment, services and providers

When a building is complete, the school will require a significant amount of information from the team managing the construction process. The process of completing and moving into a building is often so exhausting and rushed that the provision of this information is often overlooked. If left too long those with the knowledge will have long since left the site and it will be too late to retrieve the information.

Building contracts often require satisfactory performance levels by the various trades persons and the consultants responsible for oversight of the contracts should insist on due performance from trades contractors, particularly in regard to the provision of this information. To this end school councils should insist on a fees agreement which contains clauses that require due performance from the consultants, and in turn from the construction contractors. These requirements include:

- Stamped and approved council drawings and specifications including those pertaining to structure and mechanical services.
- Certificates from supply authorities approving the various installations such as water supply, sewerage, electrical and gas supply.

- Guarantees for all equipment and materials that have been called for in the contract documents
- Operating and service manuals including maintenance schedules for mechanical equipment and systems such as air-conditioning, alarm systems, public address systems, telephone and intercoms, emergency lighting
- Service agreements required as part of the contract
- lists of all contractors and subcontractors employed on the building project with contact names
- As-built drawings of buildings, landscaping and services

8.2.1. Photographic record of construction if required as part of the contract

Photographs taken during construction, carefully dated and related to the minutes of site meetings will assist greatly in future management of the building.

This information will make the task of locating underground services, prevailing ground conditions (rock under the surface), construction methods used, materials as part of the substrate (e.g. thickness of concrete or levelling screeds under floor finishes) easier at a later date.

When taking such photographs it is important to include in each picture some means of identifying the objects with something that is likely to be seen in the completed building, for example a corner of a wall, a door frame, a vent pipe.